Differential Equations *– MATH 2584-1 · MW 2:00 – 3:50 · Room SC 336*

NorthWest Arkansas Community College – Spring 2024

Instructor: *Keith Foster* Office: SC *327 & WCC 202* Phone: *479.619.4380* E-mail: *gkfoster@nwacc.edu*

Course Objectives:

1. To develop proficiency in calculus by:
   a. classify and solve first-order differential equations according to their types including separable, linear, exact, homogeneous, and Bernoulli
   b. solve n^{th} order linear equations using the method of undetermined coefficients and variation of parameters.
   c. determine Laplace and inverse Laplace transforms and apply their operational properties in the context of the translation theorems, the Convolution Theorem, and the Dirac Delta Function
   d. use Laplace transforms to solve initial value problems with constant coefficients
   e. solve first order linear systems of differential equations
   f. create and analyze mathematical models using first order differential equations to solve application problems such as mixture problems, population modeling, deflections of beams, and harmonic motion
2. To develop problem solving skills

Course Description: Topics in this first course in differential equations will include first and second order ordinary differential equations; Laplace Transforms; systems of ordinary differential equations and eigenvectors.

Textbook: *A First Course in Differential Equations with Modeling Applications*, 11th Edition by Dennis G Zill, Cengage Learning.

Prerequisites: MATH 2574 with a grade of C or better, or appropriate placement scores or consent of instructor.

Grading for Course: The numerical grade comes from the following sources:

- *Unit Exams*: There will be four unit exams each worth 100 points (total: 400 points)
- *Quizzes*: Periodical quizzes will be graded and scaled to 100 points.
- *Final Exam:* The *final exam* is worth 200 points and will be comprehensive.

Percentage score will be this numerical grade out of 700 points.

Participation Policy: Participation is expected and lack of participation will invariably prove detrimental to your grade and your learning experience. Regardless of the reason for missing class, you will be responsible for any missed assignments, material and announcements. Do NOT wait until the last minute to complete assignments.

Homework/Quizzes Policy: You are expected to work all homework problems assigned (listed on my webpage) by the start of the next section. Since this class is a four credit class, this may require you to work up to eight hours each week on homework and general overview of topics covered (spread this time out throughout the week). This is considered the norm for a college level course. Some quizzes will be taken directly from the homework assignment where you can copy from your HW Notebook, while other quizzes will have similar problems found on the homework assignments but worked without using your HW Notebook. Either way, your performance on quizzes (and exams) will be directly related to the amount of effort you put into your homework assignments. Quizzes or HW Check Quizzes will be given most days.

Exam Policy: All exams will be given as scheduled. Notes will *not* be allowed on exams. Only approved calculators are permitted during exams. The use of graphing calculators, cell phones and other technologies on exams or quizzes is prohibited. Once the exam has started, no student may leave the classroom for *any* reason, unless the student turns in the exam or quiz for grading.

Makeup Policy: There will be no make ups on exams or quizzes. I may drop a few of the quizzes, depending on the number given. I will replace your lowest exam score (or missed exam) with your final exam percent score.

Methods of Instruction: Instruction will take place through lectures, readings and working the assigned problems.

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Course Schedule: Below is a week-by-week breakdown of course coverage. Schedule is subject to change and email notice will be given.

Week	Dates	Coverage
1	Jan 15 & 17	*King Day* *Course Intro* 1.1 – Definitions and Terminology 1.2 – Initial Value Problems
2	Jan 22 & 24	1.3 – Differential Equations as Mathematical Models 2.1.1 – Direction Fields 2.2 – Separable Equations 2.3 – Linear Equations
3	Jan 29 & 31	2.4 – Exact Equations 2.5 – Solutions by Substitutions
4	Feb 5 & 7	*Exam #1* 4.1.1 – Initial-Value and Boundary-Value Problems 4.1.2 – Homogeneous Equations
5	Feb 12 & 14	4.1.3 – Nonhomogeneous Equations 4.2 – Reduction of Order 4.3 – Homogeneous Linear Equations with Constant Coefficients
6	Feb 19 & 21	4.4 – Undetermined Coefficients – Superposition Approach 4.5 – Undetermined Coefficients – Annihilator Approach 4.6 – Variation of Parameters
7	Feb 26 & 28	4.7 – Cauchy-Euler Equations 4.9 – Solving Systems of Linear Des by Elimination
8	Mar 4 & 6	4.10 – Nonlinear Differential Equations *Exam #2*
9	Mar 11 & 13	3.1 – Linear Models 3.2 – Nonlinear Models 3.3 – Modeling with Systems of First-Order DEs
	Mar 17 - 24	*Spring Break*
10	Mar 25 & 27	5.1.1 – Spring/Mass Systems: Free Undamped Motion 5.1.2 – Spring/Mass Systems: Free Damped Motion 5.1.3 – Spring/Mass Systems: Driven Motion 5.1.4 – Series Circuit Analogue
11	Apr 1 & 3	5.2 – Linear Models: Boundary-Value Problems *Exam #3*
12	Apr 8 & 10	7.1 – Definition of the Laplace Transform 7.2.1 – Inverse Transforms 7.2.2 – Transforms of Derivatives 7.3.1 – Translation on the *s*-axis 7.3.2 – Translation on the *t*-axis 7.4.1 – Derivatives of a Transform 7.4.2 – Transform of Integrals 7.4.3 – Transform of a Periodic Function
13	Apr 15 & 17	7.5 – The Dirac Delta Function 8.1 – Preliminary Theory – Linear Systems 8.2.1 – Distinct Real Eigenvalues 8.2.2 – Distinct Repeated Eigenvalues 8.2.3 – Distinct Complex Eigenvalues
14	Apr 22 & 24	8.3.1 – Undetermined Coefficients 8.3.3 – Variation of Parameters *Exam #4*
15	Apr 29 & May 1	*Catch up* *Review for Final Exam*
	May 6 - 8 **Finals Week**	**Final Exam will be given on Wednesday, May 8, 1:30 – 3:30**